

GUNSHOT WOUNDS OF THE HEART¹

SUBSEQUENT REMOVAL OF FOREIGN BODIES

Two Case Reports

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CASE I

D. D. G., age 25 years, entered Mare Island Naval Hospital, March 30, 1942, complaining of dizziness, faintness, and shortness of breath on exertion. Ordinary activity, such as walking on the level, produced no symptoms.

He entered the Navy on September 26, 1940, and considered himself perfectly well until the battle of Pearl Harbor, December 7, 1941. On that day he was aboard ship when it was struck by a bomb. The next thing he remembered he was swimming in the water, and being picked up by a small boat. As he climbed into the boat, he collapsed, and remembered nothing more until the next day when he awoke in the hospital. He remembered being very short of breath, panting "like a dog" as he lay quietly in bed. The slightest movement produced pain in his chest. An anteroposterior roentgenogram of the chest was taken but no foreign body was discovered at that time. A small dressing on his wound in the back fell off on the 5th day and was not replaced. About the 5th day, his breathing was greatly improved, and he was allowed out of bed on the 6th day. On the 8th day, he was returned to duty and with his ship went to sea. He had attacks of faintness and dizziness, accompanied by sudden and momentary blacking out of vision, which occurred with or without exertion, but particularly on climbing the ship's ladders, or when rising suddenly from a sitting or stooping position. A diagnosis of hyperthyroidism was made because of dizziness, nervousness and rapid pulse.

He remained on duty for 35 days, when he was transferred to another vessel. Here his symptoms were listed as "nervousness, lack of appetite, loss of weight, increased sweating, and dizziness on standing up suddenly." He also experienced palpitations of the heart, dropped beats, and extra systoles. Physical examination was negative at that time except for a "slight tremor of the heart." His pulse and blood pressure were recorded as "normal." A diagnosis of "psycho-neurosis and hysteria" was made, and he was returned to duty.

However, he was unable to do his work, and again he was transferred to another ship where he suffered an attack of appendicitis. Under spinal anesthesia, his appendix was removed on the U. S. Hospital Ship *Solace*. Blood pressure was recorded here as 112/72. A roentgenogram was taken on March 7, 1942, disclosing a bullet in the region of the heart. The radiologist's report is a model of completeness:

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"Fluoroscopy and films of the heart reveal the bullet to describe a dancing rotary movement with each cardiac pulsation, the motion of the posterior end of the bullet being of slightly greater amplitude than its tip. With each pulsation it also moves upward toward the base about $\frac{1}{2}$ cm. In all postures, right and left lateral, recumbent, prone, supine, oblique and exaggerated Trendelenburg, there is no shifting of position of the bullet, but the motions, synchronous with the heart beats, remain constant. The size and contour of the heart are normal, and there is no evidence of free fluid in the pericardial sac; neither is there any residual evidence of pulmonary abnormalities. The position and behaviour of the bullet leads to the conclusion that it is at least partially imbedded in the myocardial muscle near the apex."

From the U. S. Hospital Ship *Solace* he was transferred to Pearl Harbor where a blood pressure of 140/84, and a pulse rate of 82 were recorded. He was sent to Mare Island on board ship, under the care of Commander D. W. Lyon, Medical Corps, United States Navy.

On admission at Mare Island Naval Hospital he was still short of breath on exertion, and quite dizzy on assuming the erect posture suddenly. He also had occasional sharp stabs of pain in his left chest. On physical examination, the patient appeared to be a perfectly well young man of good color and excellent nourishment, with a temperature of 98.6° F.; pulse, 88; respirations, 18; and blood pressure, 110/70. There was a small oval healed scar on the posterior left thoracic wall, 3 cm. below the angle of the scapula. The heart was not enlarged. There was no murmur or friction rub to be heard. The electrocardiogram was normal. A roentgenogram (figs. 1, 2) was interpreted by Lieutenant Alexander Petrelli as showing the bullet in the region of the apex in the interventricular septum.

On April 17, 1942, the operation for the removal of the bullet was performed by the author under gas anesthesia. A curved incision was made to the left of the midline.

About 8 cm. of the fourth rib was removed together with its costal cartilage and the costal cartilages of the third and fifth ribs. An incision in the posterior periosteum and triangularis sterni muscle was made, paralleling the sternal border about 2 cm. lateral to it, revealing the underlying pericardium. The pleural cavity was not entered at any time during the operation. The pericardium, which appeared normal, was incised between two previously placed sutures. There were no adhesions, nor fluid in the anterior pericardial sac. In the midportion of the exposed anterior surface of the heart directly over the interventricular septum was a round discrete, elevated button of pink fibrous tissue, surmounted by a glistening endothelium, in the center of which could be felt the tip of the bullet lying about 8 mm. below the heart's surface. The nubbin of fibrous myocardium was incised. The bullet lay encased in a tough fibrous wall about $1\frac{1}{2}$ mm. thick. This was incised and the bullet grasped with a forceps. Traction on the forceps lifted the heart completely out of its bed, but failed to dislodge the bullet, presumably due to the creation of a vacuum behind it. Tugging on the bullet produced extreme irregularities in cardiac action. Several rather vigorous attempts at removal were unsuccessful. These were done not without considerable trepidation lest the withdrawal of the bullet be followed by uncontrollable bleeding. Several cotton sutures had been placed paralleling the incision in the myocardium for control of the bleeding by cross pulling should it occur. A grooved director was then passed alongside the bullet, admitting air back of it, thus permitting its prompt and easy removal. There was no bleeding of consequence.

Sulfathiazole was introduced into the cavity left by the bullet, following which the fibrous myocardium was closed with four interrupted cotton sutures. The pericardium was incompletely and loosely closed with two sutures so as to permit any blood or inflammatory fluid to escape into the mediastinum, thus avoiding the possibility of cardiac tamponade. The wound in the chest wall was closed in layers with cotton sutures without drainage.

Following the operation, an oxygen tent was kept handily near, but was not used. For 5 days the temperature ranged between 100.4° F. and 99.8° F., but by the 6th day it was normal and remained so. The pulse rate for 5 days lay between 118 and 114, when it, too, reached a normal of 64 to 80.

An electrocardiogram taken on the day of operation, instead of being perfectly normal as before, showed a sinus tachycardia; T_1 was lower, and T_2 had a late inversion. On the day following operation, the pulse rate was 105, and an electrocardiogram showed that " T_1 and T_2 had become elevated. The conduction times were normal and unchanged. The T-wave changes were those seen with anterior myocardial abnormalities. The S-T intervals resembled those produced by pericarditis." On April 21, the physician in chief reported a normal electrocardiogram. The patient at the present time is an ambulatory convalescent at the hospital.

CASE 2

B. J. B., age 21 years, was admitted to Mare Island Naval Hospital on December 23, 1941, with bomb fragment wounds of right chest, right elbow, and right leg. While serving on a vessel at Pearl Harbor, he was struck in three places by flying fragments. He was able to walk to C. P. O. quarters aboard ship, but after lying down does not remember anything until the following evening. At the Naval Hospital, Pearl Harbor, an oxygen mask was necessary for the first 3 days. Pains in the chest and difficulty in breathing were his chief complaints at that time. A diagnosis of hemothorax was established but not treated. He gradually improved, however, and he had no particular complaints when admitted to Mare Island Naval Hospital.

Physical examination here revealed restricted movement and impaired resonance of the right chest with a temperature of 99° F.; pulse, 72; respiration, 20. He remained in bed for 2 weeks following which there were no complaints and all wounds were healed.

On January 13, 1942, a roentgenogram showed some fluid still present in the right chest (figs. 3, 4). A jagged-edged foreign body about 1.5 cm. in diameter was disclosed lying 2 cm. to the right of the midline, posterior to the fourth interspace, about 3 cm. inside the chest. There was no fever.

On January 23, 1942, the operation for removal of the foreign body, presumably in the lung, was undertaken by the author. This decision was made not because of present trouble, but as a preventive of later difficulty which might result from the migration of the metal fragment or to its involvement in inflammation. Although small fragments may be disregarded, it was felt, because of the size, weight, and jagged character of this fragment, its removal was warranted.

Before operation the patient had not been examined fluoroscopically, which we subsequently regretted. Careful scrutiny of the roentgeno-

gram after the operation showed three superimposed shadows of the foreign body due to movement during the short exposure in taking the roentgenogram. This was considered positive proof that the foreign body moved with beating of the heart, and not with movement of the lung, as was the original interpretation. The lesson is obvious: fluoroscopy is essential in the accurate localization of all foreign bodies within the chest.

On opening the pleura no free fluid was encountered, but wide-spread filmy adhesions were found between the lower lobe and the parietal and diaphragmatic pleura. Palpation of the lung did not disclose any foreign body, and it was at once apparent that the trail of the fragment led toward the heart, where it could be palpated within the pericardium. A large circular defect was seen in the right lateral surface of the midpericardium about 2 cm. in diameter filled with fibrinous exudate. This was enlarged toward the base, disclosing the origin of the aorta with a mass of fibrinous exudate overlying it, in which was embedded the foreign body. It appeared to lie at the base of the heart immediately between the aorta and the right auricle. The channel of entrance was enlarged by spreading with a clamp. The foreign body was gingerly withdrawn with considerable apprehension lest its removal be followed by bleeding. None occurred. A culture of the bed was taken, which subsequently proved sterile. One gram of sulfanilamide was placed in the pocket from which the foreign body was removed. The pericardium was not closed so that any inflammatory fluid might escape into the pleural cavity instead of accumulating in the closed pericardium, with the production of cardiac tamponade.

The wound in the chest wall was closed in layers with cotton sutures, and an airtight closure was obtained, followed by primary healing.

The postoperative course was uneventful except that in the first 3 days there occurred several episodes of paroxysmal tachycardia accompanied by marked dyspnea. An oxygen tent provided prompt relief each time. He was discharged to ship duty, February 14, 1942. Three days later he apparently contracted a cold and was readmitted to Mare Island Naval Hospital with a fever of 101° F., pulse 110-140, respirations of 30, and pains in the right lower chest, with evidence of fluid at the right base. Under simple bed rest and sulfathiazole all signs and symptoms slowly disappeared.